

REMARKS

Claims 1-38 remain in this application. Claims 39-48 have been canceled without prejudice or disclaimer. Claims 1-4, 7-9, 19-22 and 25-27 have been amended. Claims 49-57 are newly added. No new matter has been added. Support for these amendments may be found, for example, in Figure 3 and on page 20, lines 23-26, page 21, lines 25-27, page 39, lines 4-9, page 44, table 1 and page 55, lines 9-20 of the specification. Reexamination and reconsideration of the pending claims are respectfully requested.

The Office Action objects to the drawings as failing to comply with 37 CFR 1.84(a) because the drawings allegedly do not show the feature of "the causing an etching agent having an etching action with respect to the semiconductor layer and crystal growth source material to come into contact with the semiconductor layer." *Office Action, page 2.* The Applicant respectfully disagrees.

The drawings currently include all structural detail essential for the proper understanding of the disclosed invention. Drawings are not required to illustrate every feature of a process or method claim when a drawing is unnecessary for understanding of the invention. See *M.P.E.P. 601.01(f)*. Accordingly, the Applicant respectfully requests that the objection to the drawings be withdrawn.

The Office Action rejects claims 1-3, 11-17, 19-21, 29-35 and 37 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,400,740 issued to GOTO et al. (hereinafter "GOTO"). The Applicant respectfully traverses this rejection.

Among the rejected claims, independent claim 1 has been amended to recite a cleaning treatment method for eliminating contaminant adhered to the surface of a semiconductor layer which includes "a cleaning treatment step of alternately causing i) an etching agent having an etching action with respect to the semiconductor layer, and ii) a crystal growth source material to come into contact with the semiconductor layer." Independent claim 2 has been amended to recite a cleaning treatment method for eliminating contaminant adhered to the surface of a semiconductor layer, which includes "a cleaning treatment step of alternately exposing the surface of the semiconductor layer to an atmosphere containing an etching agent having an etching action with respect to the semiconductor layer and a crystal growth source material." Independent claim 19 has been amended to recite a method of manufacturing a semiconductor device which includes "subjecting the surface of the first semiconductor layer to cleaning treatment...wherein the step of subjecting the surface of the first semiconductor layer to cleaning treatment includes a step of alternately exposing the surface of the semiconductor layer to an atmosphere containing an etching agent having an etching action with respect to the semiconductor layer and a

crystal growth source material." Independent claim 20 has been amended to recite a method of manufacturing a semiconductor device which includes "subjecting the surface of the first semiconductor layer to cleaning treatment...wherein the step of subjecting the surface of the first semiconductor layer to cleaning treatment includes a step of causing an etching agent having an etching action with respect to the semiconductor layer and a crystal growth source material to alternately come into contact with the surface of the semiconductor layer." GOTO fails to disclose at least these limitations.

GOTO discloses a method of preparing a semiconductor where a growth gas and an etch gas are supplied during vapor etching. *See column 4, lines 27-31.* However, GOTO fails to disclose "alternately" supplying an etch gas and a crystal growth during a cleaning treatment, as recited in claims 1, 2, 19 and 20. Therefore, GOTO fails to anticipate the claimed invention. For at least the aforementioned reason, claims 1, 2, 19 and 20 are patentably distinguishable over GOTO. Likewise, claims 11-17, 29-35 and 37, which variously depend from claims 1 and 19 are patentably distinguishable for at least the same reason.

Further, independent claims 3 and 21 have been amended to include the subject matter of previously dependent claims 4 and 22. Specifically, claim 3 has been amended to recite a cleaning treatment method for eliminating contaminant adhered to the surface of a semiconductor layer which includes "a cleaning

treatment step of simultaneously providing a first gas including an etching agent having an etching action with respect to the semiconductor layer and a second gas including a crystal growth source material to the surface of the semiconductor layer, wherein the first gas and the second gas are supplied in an intermittent manner." Claim 21 has been amended to recite a method of manufacturing a semiconductor device which includes "subjecting the surface of the first semiconductor layer to cleaning treatment...wherein the step of subjecting the surface of the first semiconductor layer to cleaning treatment includes a step of simultaneously supplying a first gas including an etching agent having an etching action with respect to the semiconductor layer and a second gas including a crystal growth source material to the surface of the semiconductor layer, where the first gas and the second gas are supplied in an intermittent manner." GOTO fails to disclose at least these features.

As discussed above, GOTO discloses supplying a growth gas and an etch gas during vapor etching in a semiconductor preparation method. See column 4, lines 27-31. However, GOTO is silent as to the method in which the gases are supplied. In the Office Action, the Examiner relies on U.S. Patent 5,785,755 issued to NAKAMURA et al. (hereinafter "NAKAMURA") in an attempt to cure the deficiencies of GOTO. However, NAKAMURA cannot be relied upon to teach or suggest at least these features.

NAKAMURA teaches intermittently supplying growth gases during a growth step. See column 3, line 60- column 4, line 15. However, NAKAMURA fails to teach or suggest a cleaning treatment step "wherein the first gas and the second gas are supplied in an intermittent manner," where the first gas includes an etching agent and the second gas includes a crystal growing agent, as recited in claims 3 and 21. Therefore, the claimed invention is patentably distinguishable over the teachings of GOTO and NAKAMURA, singularly or in combination.

For at least the aforementioned reason, claims 3 and 21 are patentably distinguishable over the prior art.

Accordingly, the Applicant respectfully requests that the 35 U.S.C. §102(b) rejection of claims 1-3, 11-17, 19-21, 29-35 and 37 be withdrawn.

The Office Action rejects claims 4, 18, 22 and 36 under 35 U.S.C. § 103(a) as being unpatentable over GOTO in view of NAKAMURA. The Applicant respectfully traverses this rejection. As previously discussed, GOTO fails to teach or suggest each and every feature of claims 1, 3, 19 and 21, the independent claims from which claims 4, 18, 22 and 36 variously depend. NAKAMURA fails to address the previously noted shortcomings of GOTO, namely "alternately" supplying an etch gas and a crystal growth during a cleaning treatment, as recited in claims 1 and 19 and a cleaning treatment step "wherein the first gas and the second gas are supplied in an intermittent manner," where the first gas

includes an etching agent and the second gas includes a crystal growing agent, as recited in claims 3 and 21.

Thus, even if one skilled in the art were to contemplate modifying GOTO in view of NAKAMURA, as suggested, the modification would still fail to teach or suggest each and every feature recited in claims 1, 3, 19 and 21. Since neither of the references teaches or suggests each and every feature recited in these claims, the teaching of GOTO in view of NAKAMURA does not render the claimed invention obvious.

Moreover, claims 4 and 22 have been amended to recite "the first gas and the second gas are supplied intermittently for fixed periods of time, where a time of supplying the first and second gases and a time of not supplying the first and second gases are alternately repeated."

Neither GOTO nor NAKAMURA teaches or suggests at least this limitation. Therefore, even if one skilled in the art contemplated modifying GOTO in view of NAKAMURA, as suggested, the resulting modification would fail to render these claims obvious.

For at least the aforementioned reasons, the Applicant submits that claims 4, 18, 22 and 36 are patentably distinguishable over GOTO in view of NAKAMURA and requests that the 35 U.S.C. § 103(a) rejection be withdrawn.

The Office Action rejects claims 5-10 and 23-28 under 35 U.S.C. § 103(a) as being unpatentable over GOTO in view of

U.S. Patent No. 5,827,365 issued to SHIMOYAMA et al. (hereinafter "SHIMOYAMA"). The Applicant respectfully traverses this rejection.

As previously discussed, GOTO fails to teach or suggest each and every feature of claims 1, 3, 19 and 21, the independent claims from which claims 5-10 and 23-28 variously depend. Moreover, SHIMOYAMA fails to address the previously noted shortcomings of GOTO, namely "alternately" supplying an etch gas and a crystal growth during a cleaning treatment, as recited in claims 1 and 19 and a cleaning treatment step "wherein the first gas and the second gas are supplied in an intermittent manner," where the first gas includes an etching agent and the second gas includes a crystal growing agent, as recited in claims 3 and 21. Thus, even if one skilled in the art were to contemplate modifying GOTO in view of SHIMOYAMA, as suggested, the modification would still fail to teach or suggest each and every feature recited in claims 1, 3, 19 and 21. Thus, the teaching of GOTO in view of SHIMOYAMA does not render the claimed invention obvious.

Therefore, the Applicant submits that claims 5-10 and 23-28 are patentably distinguishable over GOTO in view of SHIMOYAMA and respectfully requests that the 35 U.S.C. § 103(a) rejection be withdrawn.

The Office Action rejects claim 38 under 35 U.S.C. § 103(a) as being unpatentable over GOTO in view of U.S. Patent

No. 5,679,603 issued to KIMURA et al. (hereinafter "KIMURA").
The Applicant respectfully traverses the rejection.

As previously discussed, GOTO fails to teach or suggest each and every feature of claim 19, the independent claim from which claim 38 depends. Moreover, KIMURA fails to address the previously noted shortcomings of GOTO, namely "alternately" supplying an etch gas and a crystal growth during a cleaning treatment.

Thus, even if one skilled in the art were to contemplate modifying GOTO in view of KIMURA, as suggested, the modification would still fail to teach or suggest each and every feature recited in claim 19. Thus, the teaching of GOTO in view of KIMURA does not render the claimed invention obvious.

Therefore, the Applicant submits that claim 38 is patentably distinguishable over GOTO in view of KIMURA and respectfully requests that the 35 U.S.C. § 103(a) rejection be withdrawn.

Likewise, newly added claims 49-57 are also patentable distinguishable over the cited prior art for at least the aforementioned reasons. Moreover, none of the cited prior art teaches or suggests a cleaning treatment method having a rate relation of $|R| < |r_2| < |r_1|$. This claimed rate relation achieves the unexpected result of appropriately balancing the supply of etching agent and crystal growth source material such

that contaminant adhered to the semiconductor layer surface can be effectively eliminated and reattachment of the detached contaminant to the semiconductor layer can be suppressed. See, for example, page 10, lines 10-16. Accordingly, a rate relation of $|R| < |r_2| < |r_1|$ is not merely a matter of design choice. Therefore, this claimed feature must be given patentable weight and examined on the merits.

Entry of the above amendments is earnestly solicited. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below. This response is believed to be fully responsive and to put the case in condition for allowance. An early and favorable action on the merits is earnestly requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

/Elizabeth M. Keaney/
Elizabeth M. Keaney, Reg. No. 60,437
209 Madison Street
Suite 500
Alexandria, VA 22314
Telephone (703) 521-2297
Telefax (703) 685-0573
(703) 979-4709

EMK/lk/lrs